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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/670,520	09/26/2000	Wakako Moriyama	197802US2S	4460

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EXAMINER

LEE, GRANVILL D

ART UNIT PAPER NUMBER

2825

DATE MAILED: 04/25/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/670,520

Applicant(s)

MORIYAMA ET AL.

Examiner

Granvill D Lee, Jr

Art Unit

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-- Th MAILING DATE of this communication appears on th cov r sh t with the correspond nc addr ss --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 26 September 2000.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-22 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

### Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

Claims 1 and 4 are rejected under 35 U.S.C. 102(e) as being anticipated by Gardener et al. (US Pat. 6,127,251).

In view of claim 1, Gardener reveals a device by forming a gate insulating film (Fig. 4 #18) made of oxynitride (Col. 5 lines 28-31) on the main surface of the substrate (Fig. 4 #12), followed by forming gate electrodes (#20) on the film layer, with diffused layers on both sides of the gate electrodes (#38), and the partial removal of the gate insulating film (Fig. 2 #19). In view of claim 4, the

removal of the gate (#18 or #19) is completed by an etching process (Col. 5 line 65-Col. 6 line 10) above the diffused layers.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 2-3 and 6-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gardener et al. (US Pat. 6,127,251) in view of Rama et al. (Pub.).

Gardener et al. reveals a device by forming a gate insulating film (Fig. 4 #18) made of oxynitride (Col. 5 lines 28-31) on the main surface of the substrate (Fig. 4 #12), followed by forming gate electrodes (#20) on the film layer, with diffused layers on both sides of the gate electrodes (#38), and the partial removal of the gate insulating film (Fig. 2 #19). In view of claim 4, the removal of the gate layer (#18 or #19) is completed by an etching process (Col. 5 line 65-Col. 6 line 10) above the diffused layers. However, Gardener et al. does not discuss a thermally oxidizing process, which includes a nitrified oxide film. But, Rama et al. includes a process where the substrates are essentially oxidized two times, one thermally and the other by a vapor method (Abstr.).

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Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the teachings of Gardener et al. with those of Rama et al. with the intent examining more closely the role of oxidizing on the properties of a film layer (1<sup>st</sup> and 2<sup>nd</sup> para.).

In view of claim 2, Rama et al. includes a process where the substrates are essentially oxidized two times, one thermally and the other by a vapor method (Abstr.).

In view of claim 3, Gardener et al. details a process where an etch is performed on a gate insulating layer using hydrochloric acid (Col. 3 lines 37-41). Rama et al. uses a hydroflouric acid to etch a oxynitride film (Pg. 2883 3<sup>rd</sup> Para.).

In view of claim 6, Rama et al. includes a step to employ a post or double oxidation method (Abstr.).

In view of claim 7, the Rama et al. process includes nitrogen and oxygen added to an ambient air (2<sup>nd</sup> para.).

In view of claim 8, the Rama et al. procedure of annealing in a NO ambient is a vapor process.

Claims 5 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gardener et al. (US Pat. 6,127,251) in view of Jeong (6.093,604).

In view of these claims, Gardener et al. reveals a device by forming a gate insulating film made of oxynitride on the main surface of the substrate, followed by forming gate electrodes on the film layer, with diffused layers on both sides of the gate electrodes, and the partial removal of the gate insulating film. An etching process above the diffused layers completes the partial removal of a gate film layer. However, Gardener et al. does not show a layer being formed in the space after the removal of part of the gate layer. Jeong makes a flash memory device where the etch layer is replaced with a thin insulating (dielectric) layer (Fig. 4g #38). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the teachings of Gardener et al. with those of Jeong with the desire to allow only selected electrons into the area of charge (Col. 45 lines 37-45). Jeong using a dielectric and the concept of tunneling, knew that only high energy electrons would add to the current, furthermore, using an insulator would prevent any charge from entering the gate region which could be desirable in some applications.

Claims 10-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gardener et al. (US Pat. 6,127,251) in view of Rama et al. (Pub.) in further view of Gardener et al. (US Pat. 6,252,283).

In view of claims 10, 20 and 22, Gardener et al. reveals a device by forming a gate insulating film made of oxynitride on the main surface of the substrate, followed by forming gate electrodes on the film layer, with diffused

layers on both sides of the gate electrodes, and the partial removal of the gate insulating film. An etching process above the diffused layers completes the partial removal of a gate film layer. Rama et al. conducts a study where a two-step process of the substrate is essentially oxidized two times accomplished at 950 degrees C. But neither inventor describes in the device making process, a nitrogen concentration that differs from the layer portion on the diffused layers and the portion under the gate electrode. However, Gardener shows that the concentration of nitrogen can vary vertically within the gate insulation layer (Fig. 3 #54). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the teachings of Gardener et al. and Rama et al. with those of Gardener et al. ('83) in order to enhance the resistance to migration of the dopants, which would otherwise cause device breakdown (Col. 5 lines 20-30). (Note, that although applicant claims horizontal variation of nitrogen concentration, it has been held that this rearranging of parts where nitrogen concentrations occur involves only routine skill in the art. In re Japikse, 86 USPQ 70.)

In view of claims 11, 12 and 21, Rama et al. shows a procedure of annealing in a NO ambient is a vapor or wet oxidation process (Pg. 2882 2<sup>nd</sup> para.), including a pre and post oxidized process step (Abstr.).

In further view of claims 13 and 17, as indicated in claim 10 above, Gardener ('51) shows forming a fourth film on the sidewalls (Fig. 3 #27) and the source/drain regions (#23).

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In view of claims 14 and 18, Rama et al. includes a step to employ a post or double oxidation method (Abstr.).

In view of claim 15, Gardener et al. ('51) details a process where an etch is performed on a gate insulating layer using hydrochloric acid (Col. 3 lines 37-41). Rama et al. uses a hydrofluoric acid to etch a oxynitride film (Pg. 2883 3<sup>rd</sup> Para.).

In view of claim 16, Gardener et al ('51) removes the gate layer (#18 or #19) and is completed by an etching process (Col. 5 line 65-Col. 6 line 10) above the diffused layers.

In view of claim 19, Rama et al. includes a step to employ a post or double oxidation method (Abstr.) on the gate oxide layer, which includes a vapor method process.

### **Contact Information**

Any inquiry concerning this communication or earlier communications for the examiner should be directed to Granvill Lee whose telephone number is (703) 306-5865. The examiner can be normally reached on Monday thru Thursday from 7:00 am to 5:30 pm.

If attempts to reach the examiner by telephone are not successful, the examiner's supervisor, Matthew Smith can be reached on (703) 308-1323. The fax phone number for this group is (703) 308-7722.



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Any inquiry of a general nature relating to status or otherwise should be directed to the receptionist whose telephone number is 703-308-1782.

Examiner  
Granvill Lee  
Art Unit 2825

G1  
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*C. Evershart*  
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